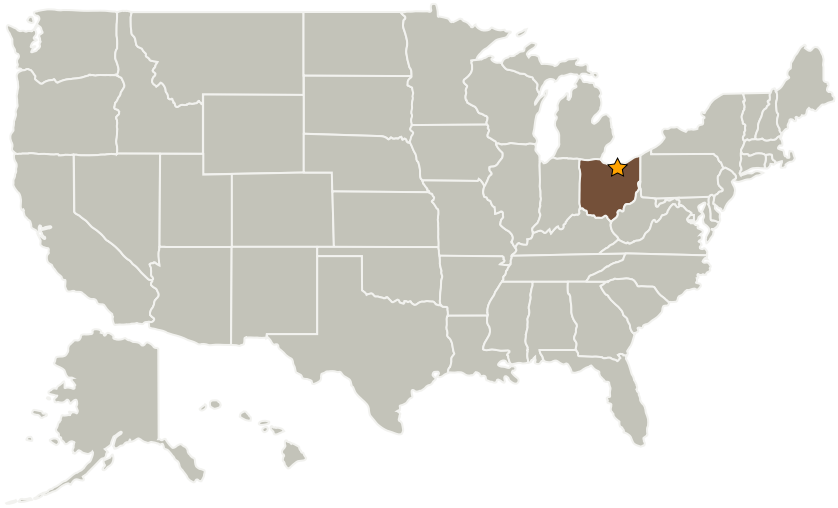
High Efficiency Quantum Dot III-V Thermophotovoltaic Cell for Space Power, Phase I

Completed Technology Project (2005 - 2005)

Project Introduction

Quantum dots are nanoscale materials that have already improved the performance of optical sensors, lasers, light emitting diodes and solar cells. The unique properties of these nanomaterials offer tremendous benefit in developing high efficiency thermophotovoltaic cells as well. Theoretical studies predict a potential efficiency of 63.2% for an array of quantum dots sandwiched between the emitter and base layers in a typical photovoltaic junction. Significant gains can also be expected in the case of thermophotovoltaic cells. We propose an InGaAs TPV cell which incorporates InAs quantum dots to provide sub-gap absorption and thus improve the short-circuit current. This cell could then be integrated into a MIM to achieve a TPV cell whose efficiency would significantly exceed (by about 15% to 20%) current SOA standards. These TPV cells can be used for deep space missions, with a radioisotope thermoelectric generator (RTG) fueled by plutonium-238 as the on-board source of heat.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Essential Research, Inc.	Supporting Organization	Industry	Cleveland, Ohio

High Efficiency Quantum Dot III-V Thermophotovoltaic Cell for Space Power, Phase I

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

High Efficiency Quantum Dot III-V Thermophotovoltaic Cell for Space Power, Phase I

Completed Technology Project (2005 - 2005)

Primary U.S. Work Locations
Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

William D King

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.6 Other Advanced Concepts for Generating/Converting Power